

# ROCKLAND COUNTY

ID NO COMMUNITY WATER SYSTEM

POPULATION SOURCE

## Municipal Community

1	Lake Lucille Property Owners Association. . . . .	NA.	Wells
2	Nyack Village. . . . .	20000.	Hackensack River
3	Pothat Water Company. . . . .	125.	Potake Pond
4	Spring Valley Water Company Inc. . . . .	227900.	Deforest Lake, Cedar Brook, Wells
5	Suffern Village. . . . .	11100.	Wells

50,000+ (xs)  
60,00

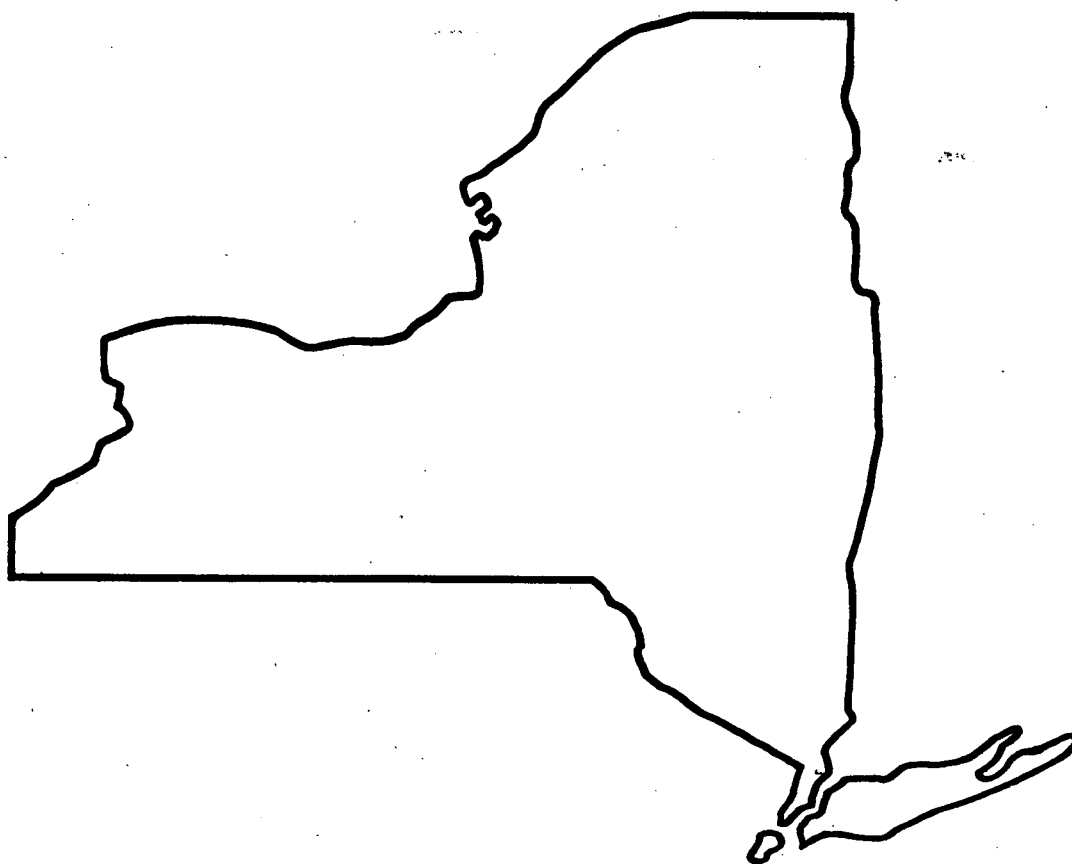
## Non-Municipal Community

6	Barmore Pump & Electric Company. . . . .	17.	Wells
	Bear Mountain State Park (See No 93 Orange Co, Page 72)		
7	Birchwood Bungalows. . . . .	140.	Wells
8	Cedar Park Trailer Park. . . . .	17.	Wells
9	Cozy Bungalows. . . . .	NA.	Wells
10	Doodletown Water System (See also No 104 Orange Co, Page 72). . . . .	20000.	Doodletown Pond
11	Fountain Head Trailer Park. . . . .	100.	Wells
12	George Demas. . . . .	30.	Wells
13	Helen Hayes Hospital. . . . .	500.	Wells
14	Hitor Properties. . . . .	450.	Wells
15	Ivy Glen Trailer Park. . . . .	50.	Wells
16	JDR Realty Trailer Park. . . . .	30.	Wells
17	Letchworth Village Developmental Center. . . . .	5400.	Horse Chock Brook (First Reservoir)
18	Mazza Trailer Park. . . . .	20.	Wells
19	Mazza-Leone Mobile Home Court. . . . .	80.	Wells
20	Mt Ivy Trailer Park. . . . .	170.	Wells
21	Mt View Trailer Park. . . . .	190.	Wells
22	Parkway Trailer Court. . . . .	240.	Wells
23	Russian Orthodox Convent-Home. . . . .	70.	Wells
24	Simons Bungalows. . . . .	30.	Wells
25	St Dominic's Convent-Home. . . . .	250.	Wells
26	St Mary Villa. . . . .	55.	Sheppard Pond (New Jersey)
27	Sunrise Bungalows. . . . .	20.	Wells
28	Tolstoy Foundation. . . . .	115.	Wells
29	Wexler Apartments. . . . .	45.	Wells





**REPORT ON GROUND WATER DEPENDENCE  
IN  
NEW YORK STATE**



**BY  
NEW YORK STATE DEPARTMENT OF HEALTH  
DIVISION OF ENVIRONMENTAL HEALTH  
BUREAU OF PUBLIC WATER SUPPLY**

**1981**

RAMAPO AND MAHWAH RIVER VALLEYS - ROCKLAND CO.Community Water SupplyPopulation

## Overburden Wells

- |                            |                  |
|----------------------------|------------------|
| 1. Spring Valley Water Co. | 39,000 (3.9 mgd) |
| 2. Suffern Village         | 9,500            |

## Bedrock Wells

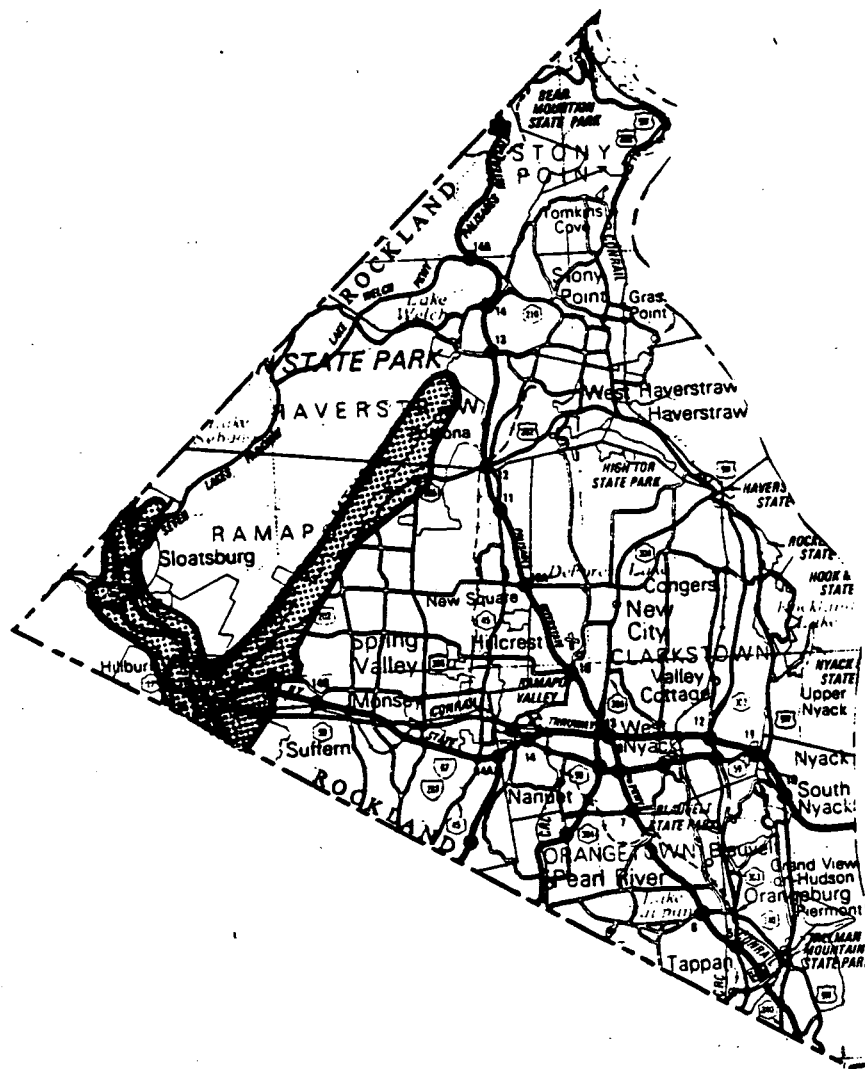
- |                            |                  |
|----------------------------|------------------|
| 1. Spring Valley Water Co. | 26,000 (2.6 mgd) |
| Total*                     | 74,500           |

\*Program Code 100's - See Page 10 for definition.

The Ramapo Aquifer is located in the Ramapo and Mahwah River Valleys. The aquifer consists of unconsolidated glacial deposits of sand and gravel to a maximum known depth of 116 feet.

The yield of wells will vary depending upon location in the aquifer. Wells located in the Pleistocene sand and gravel deposits and fully penetrating the aquifer will yield in excess of 200 gpm. Wells located in the proximity to the river and induce infiltration from the river will yield as high as 1500 gpm.

## RAMAPO-MAHWAH RIVER VALLEYS AQUIFER

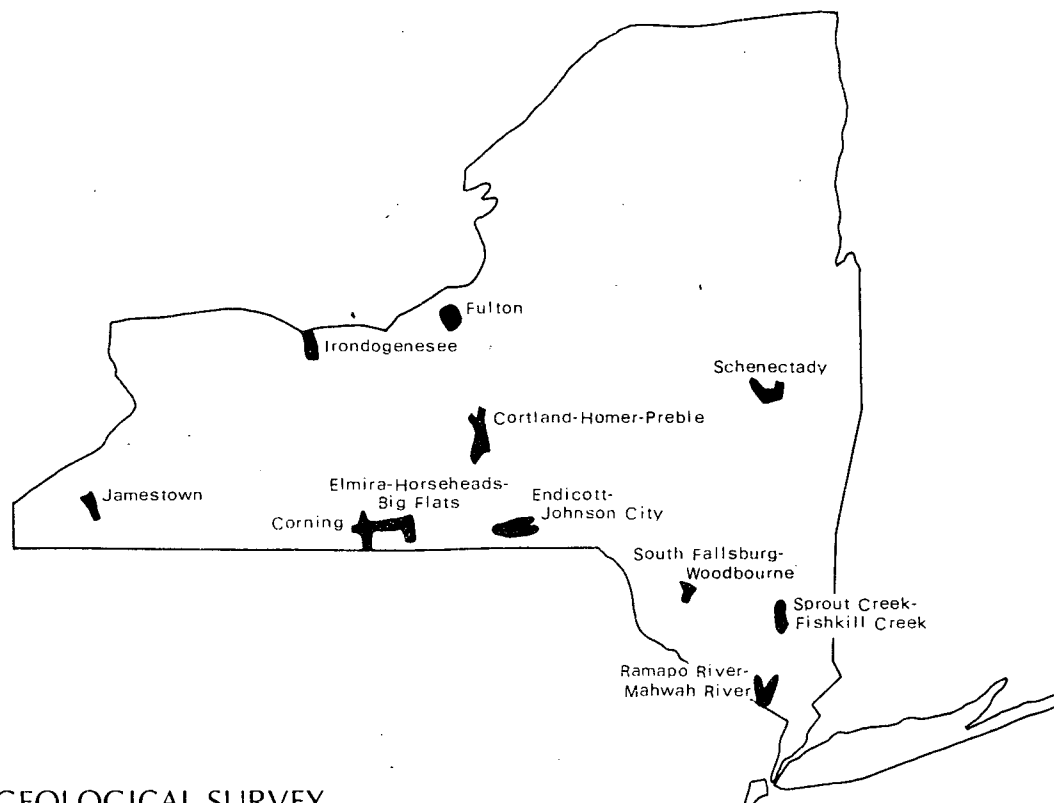


SCALE 1:250,000

5 MILES

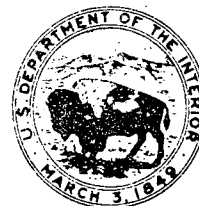
NORTH

# Atlas of Eleven Selected Aquifers in New York



U.S. GEOLOGICAL SURVEY  
Water-Resources Investigations  
Open-File Report 82-553

Prepared in cooperation with  
**NEW YORK STATE DEPARTMENT OF HEALTH**  
Bureau of Public Water Supply Protection



## 4

# RAMAPO RIVER—MAHWAH RIVER AREA

By Richard B. Moore

- A. Location and major geographic features
- B. Population and ground-water use
- C. Geologic setting
- D. Geohydrology
- E. Aquifer thickness
- F. Ground-water movement
- G. Well yields
- H. Soil-zone permeability
- I. Land use
- J. Present and potential problems
- K. Selected references

4 RAMAPO RIVER—MAHWAH RIVER AREA  
A. Location and major geographic features

**Much of this aquifer system underlies a heavily urbanized area**

*This aquifer system occupies the valleys of the Ramapo and Mahwah Rivers, which are tributary to the Passaic River in New Jersey. The area contains three physiographic sections — the Ramapo Mountains in the central and west part, a low, hilly terrain in the east, and the flat, Y-shaped valley. Industry and urbanization are heaviest near the confluence of the two rivers, near Suffern.*

This aquifer system underlies the valley floor of the Ramapo and Mahwah River valleys. It lies mostly in Rockland County but extends into Orange County to the northwest and into Bergen County, N.J., to the south (fig. 4A). Within Rockland County, the aquifer system occupies 6 square miles. The Ramapo River flows from Orange County southward through Rockland County into New Jersey; the Mahwah River, which originates approximately ½ mile northeast of the aquifer, flows southwestward and enters the Ramapo 1 mile south of the New Jersey border. The Ramapo River is tributary to the Passaic River, which discharges into the ocean from northern New Jersey.

The valley floor has a gently sloping surface ranging in altitude from 270 to 530 feet above sea level. The drainage area (fig. 4A) to the aquifer occupies 115 square miles. The narrow valley floor of the Ramapo River is a corridor for the New York State Thruway and a railroad. Heavy urbanization and industry have developed at the confluence of the two valleys.

FIGURE 4A RAMAPO RIVER—MAHWAH RIVER AREA  
Location and major geographic features

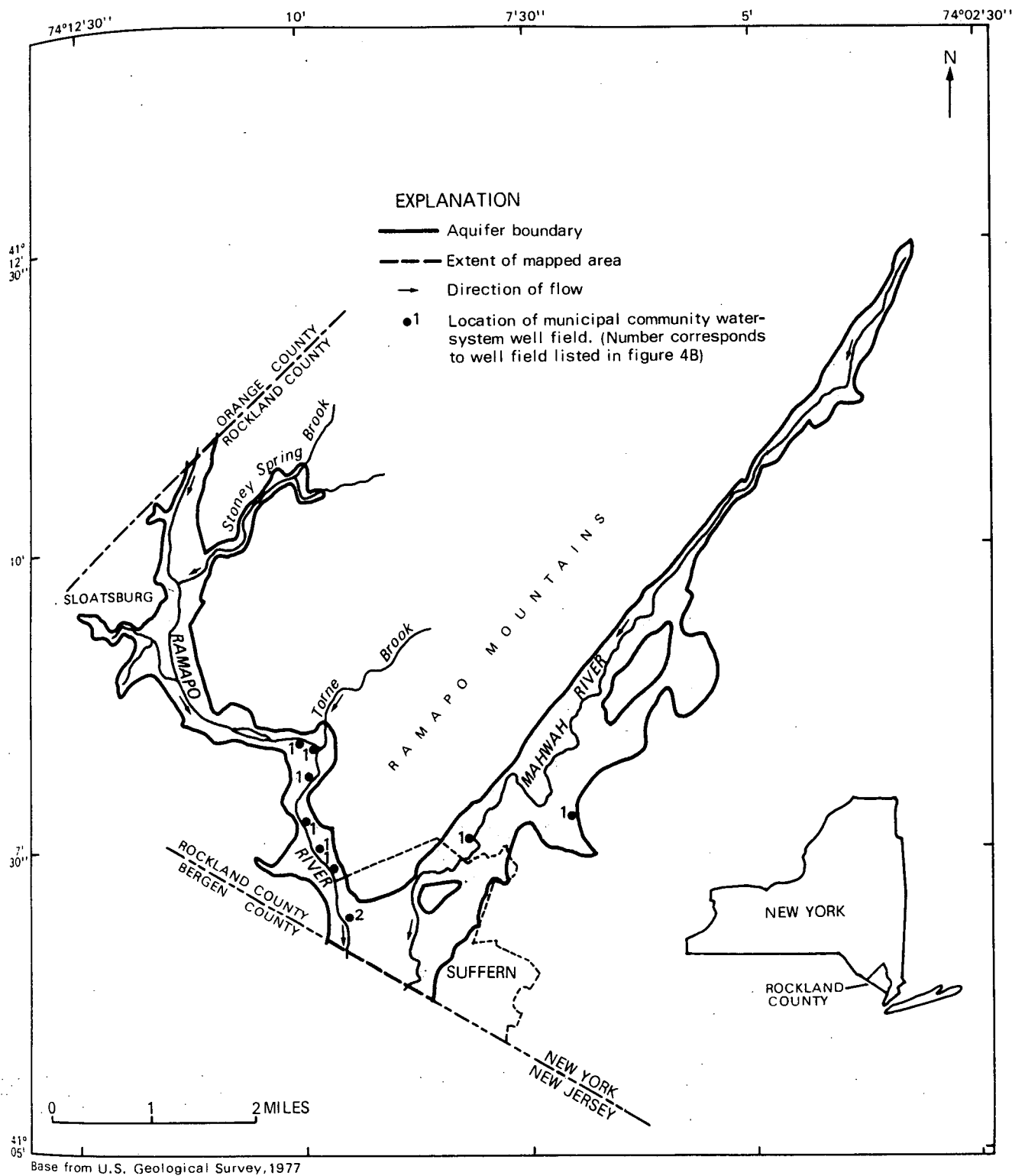


FIGURE 4B RAMAPO RIVER—MAHWAH RIVER AREA  
Population and ground-water use

**POPULATION AND PUMPAGE FROM  
RAMAPO RIVER — MAHWAH RIVER AREA, 1980**

Source	Population served <sup>1</sup>	Average pumpage <sup>2</sup> (Mgal/d)
<b>A. MUNICIPAL COMMUNITY WATER SYSTEMS</b>		
1. Spring Valley Water Co. (several well fields)	* 69,000	7.789
2. Village of Suffern	11,100	1.821
<b>Subtotal</b>	80,100	9.610
<b>B. PRIVATE WATER SUPPLIES</b>		
Home use of 100 gallons per day per person is assumed	* 1,500	* .015
<b>Total</b>	* 81,600	* 9.625

<sup>1</sup> Revised from New York State Department of Health (1981)

<sup>2</sup> Unpublished data from New York State Department of Health

\* Estimated

4 RAMAPO RIVER—MAHWAH RIVER AREA  
B. Population and ground-water use

**This aquifer provides water to over 81,000 people**

*More than 81,000 people use water from this valley-fill aquifer. An estimated 9.6 million gallons per day is withdrawn.*

Ground-water use in the Ramapo and Mahwah River area is unique in that a private water company serves most of the area (fig. 4B). The Village of Suffern has its own ground-water supply, and some homes and industries or commercial enterprises have private supplies. More than 81,000 people use a total of 9.6 Mgal/d from this aquifer.

The table opposite lists 1980 pumpage by the various water suppliers. Locations of municipal systems are shown on the map below and in figure 4A.

LOCATION OF MUNICIPAL COMMUNITY  
WATER-SYSTEM WELL FIELDS

Numbers correspond to well  
fields listed opposite

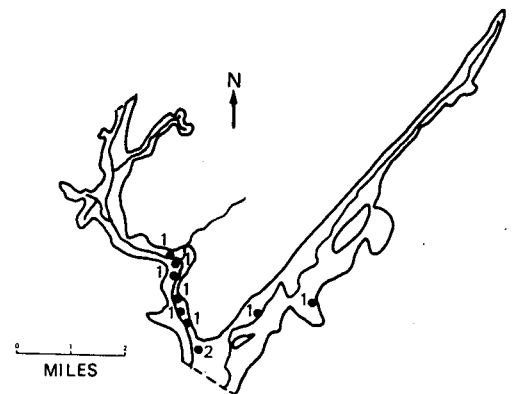
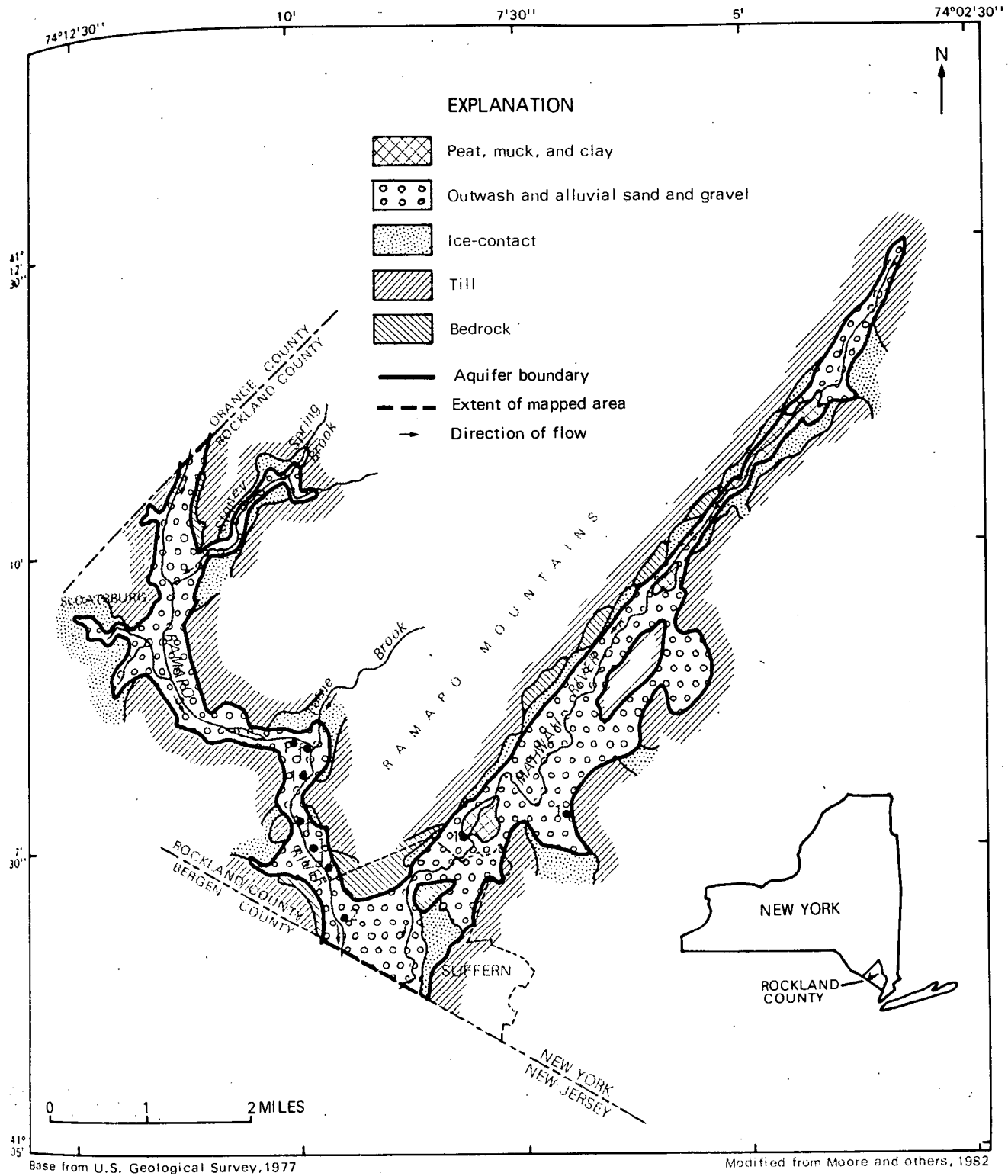


FIGURE 4C RAMAPO RIVER—MAHWAH RIVER AREA  
Geologic setting



#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### C. Geologic setting

#### **A fault along the Mahwah valley bisects the area**

*The area contains two distinct zones — a highland and a lowland — both of which have been modified by glacial and alluvial deposition. The aquifer lies within the valley-fill deposits.*

Bedrock within this area consists of two main categories of rock — granite, gneiss, and schist in the southeast, and sedimentary sandstone, shale, and conglomerate to the northwest (Perlmutter, 1959). These two major units are separated by a fault running along the Mahwah valley (fig. 4C).

This general setting was modified by glaciation. At the time of glacial maximum, ice covered the entire county and deposited poorly sorted clay, silt, sand, and boulders over most of the area except on steep hillsides. Small hills of lodgment till (drumlins) are common east of the fault, but only one major one is shown at this scale (fig. 4C). During deglaciation, meltwater streams deposited gravel, sand, and some silt and clay in the valleys. Postglacial alluvium consisting mostly of reworked glacial materials now blankets the valley floors. A few deposits of peat, muck, and clay, also formed postglacially, lie along the Mahwah valley axis.

This region contains deposits associated with two cycles of glaciation. These could have been a local fluctuation of the ice terminus during a general period of retreat or they could have been two major advances, each followed by extensive deglaciation. Evidence that the area was twice covered by glacial ice is indicated by two layers of till in the glacial deposits in the middle of the lower Mahwah valley, where till overlying bedrock is overlain by outwash that is in turn overlain by a large lens of lodgment till.

#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### D. Geohydrology

### **This aquifer system contains two layers locally**

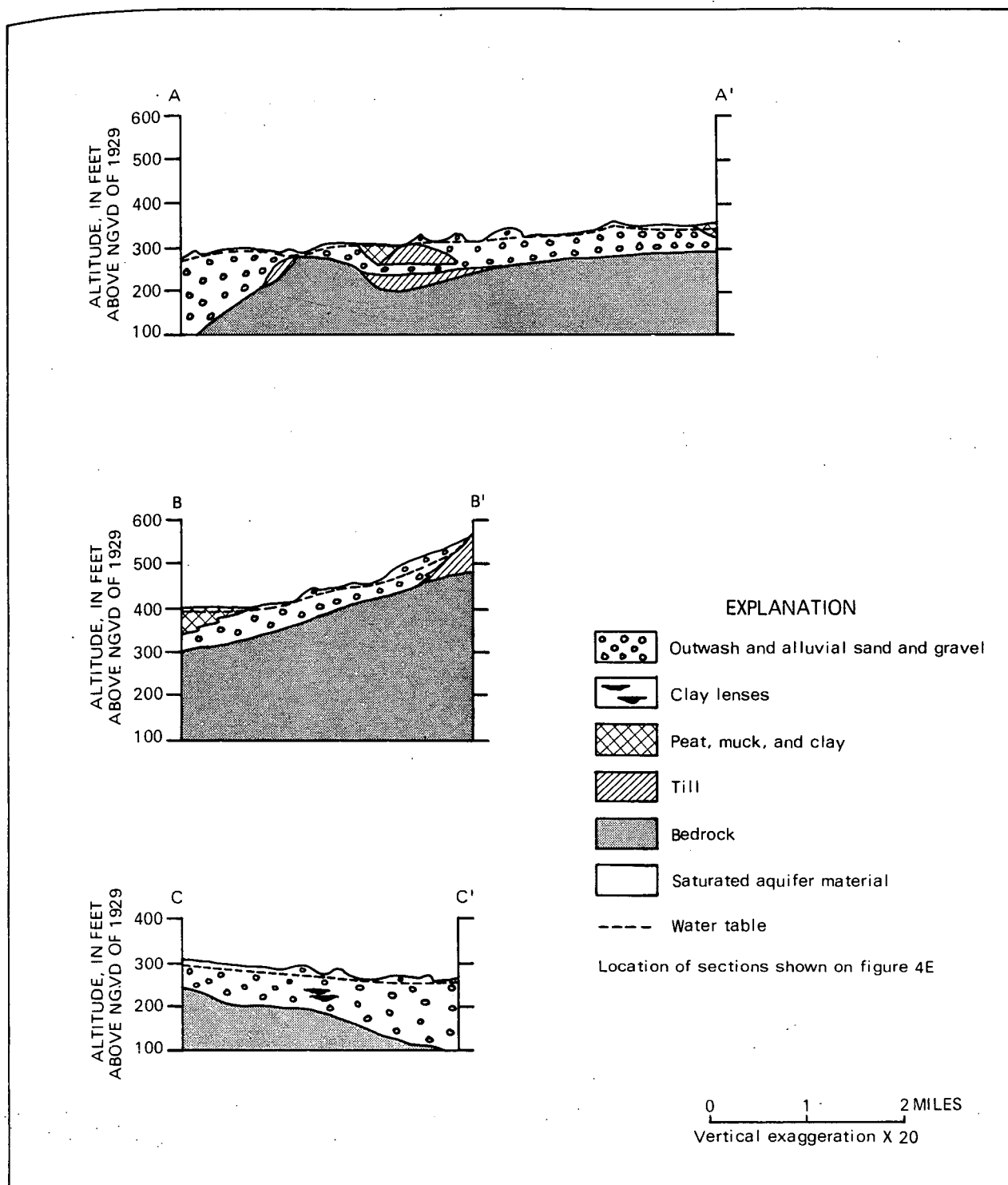
*Two buried bedrock channels roughly parallel the modern riverbeds. The channels were carved by streams ancestral to the modern rivers and are filled with sand and gravel from at least two glacial periods.*

The bedrock surface, which forms the base of the aquifer system, contains two major channels buried by unconsolidated deposits. These channels, which were carved by preglacial equivalents of the Ramapo and Mahwah Rivers, converge beneath the southern part of the aquifer near Suffern (fig. 4D). These channels diverge from the present rivers in places. The northeastern part of section A-A' and all of section B-B' roughly follow the preglacial Mahwah River channel; the southern part of this channel presumably continues south of section A-A' into New Jersey. The preglacial Mahwah River channel roughly follows the fault zone between the igneous-metamorphic and sedimentary bedrock. In New Jersey, the present-day Ramapo River continues along this fault.

The aquifers consist of highly permeable outwash sand and gravel (fig. 4D). Each of the two glacial advances laid down outwash sand and gravel units, shown in section A-A'. Clay lenses within the lower outwash in section C-C' contain wood fragments (Leggette, Brashears and Graham, 1974), which indicates that the clay was deposited during a period when the area had been free of ice long enough for woody plants to grow.

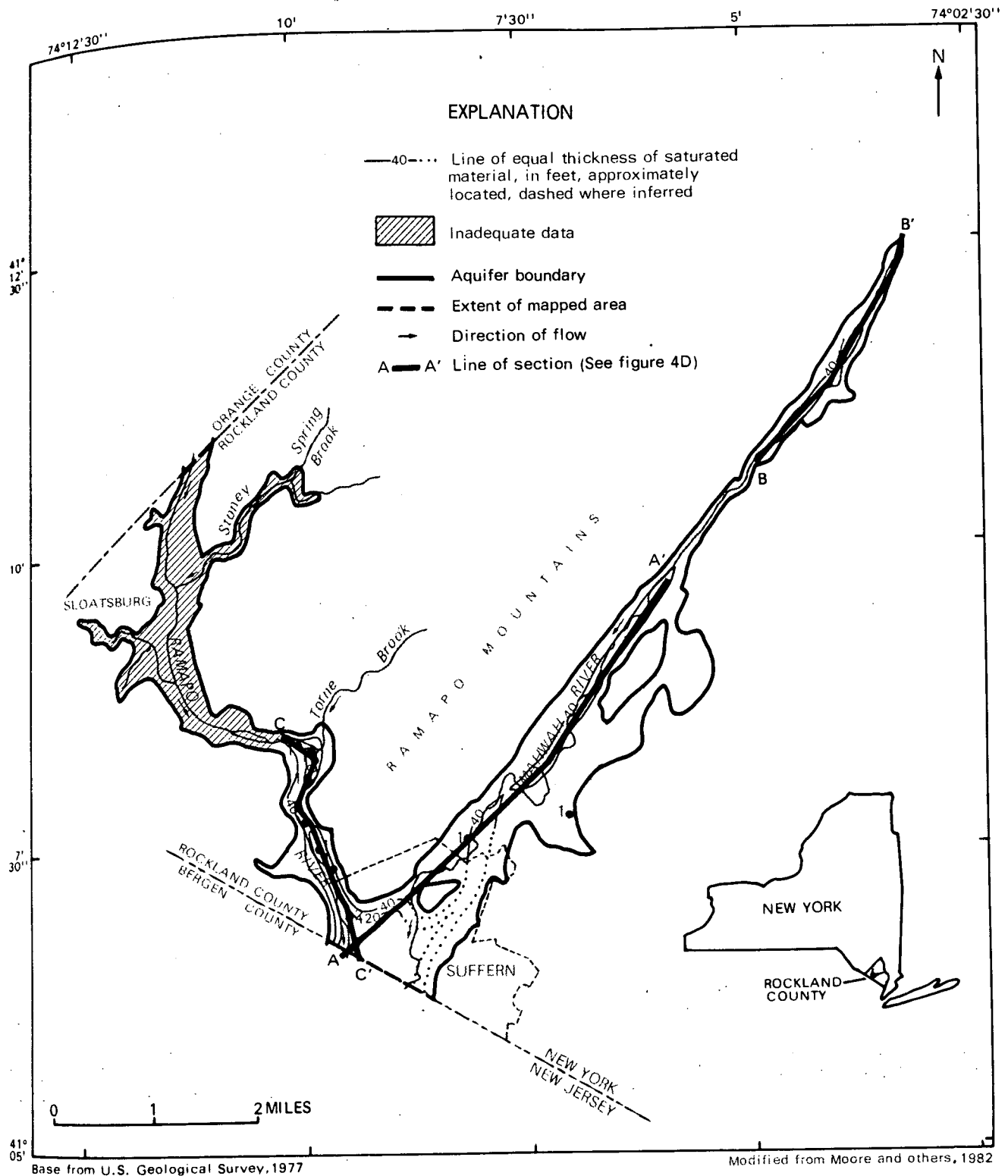
Postglacial stream erosion has reworked the glacial sediments, and alluvial silt and sand now overlies outwash throughout the two valleys. The peat and muck deposits along the valley floor were formed postglacially in temporary tranquil-water environments.

FIGURE 4D RAMAPO RIVER—MAHWAH RIVER AREA  
Geohydrology



Modified from Moore and others, 1982

FIGURE 4E RAMAPO RIVER—MAHWAH RIVER AREA  
Aquifer thickness



#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### E. Aquifer thickness

**This aquifer system is thickest near the New Jersey border**

*This aquifer system contains sediments ranging from very fine to coarse, with scattered lenses of silt and clay near the New Jersey border. Saturated sand and gravel is thickest where the bedrock channels are deepest.*

The estimated total aquifer thickness (saturated sand and gravel) from the static water table to bedrock is given in figure 4E. The sediments range from very fine sand to coarse gravel and include a few lenses and layers of silt and clay, especially near the New Jersey border. Deposits of till, silt, clay, or muck have low permeability and are not considered part of the aquifer thickness.

Saturated thickness of sediments within a part of the bedrock channel underlying the Mahwah River valley is suggested by dotted lines; the exact size and location of this part of the buried channel can be only inferred. The gap in the area enclosed by the 40-foot contour 1.5 mile northeast of the bedrock knob (fig. 4E) is where the channel is partly filled by lodgment till, which is not considered part of the aquifer. (See also section A-A' in fig. 4D.) Saturated thickness of channel-fill sand and gravel in the southern section of the Ramapo limb of the aquifer is indicated, but data are insufficient to enable mapping of the northern section.

4 RAMAPO RIVER—MAHWAH RIVER AREA  
F. Ground-water movement

**Sustained heavy pumping may reduce flow in the Ramapo River**

*The ground-water flow system discharges to the surface-water system. Recharge occurs from direct precipitation upon the aquifer area, from runoff, and ground-water flow from adjacent areas. Recharge may be induced locally from rivers by pumping wells.*

The water table fluctuates seasonally in response to recharge and discharge. Recharge occurs over the entire aquifer, especially where the soils have high permeability. Recharge also occurs along the valley margins, where runoff from the hillsides reaches the valley floor, and from underlying and adjacent till and bedrock, as well as from the upstream section of the Ramapo valley in Orange County. Recharge may also be induced from the rivers by heavily pumped wells. Discharge occurs principally through evapotranspiration, seepage to streams, through wells, and as ground-water flow downvalley into New Jersey.

The water-table contours in figure 4F represent the estimated average altitude of the water table under nonpumping conditions. The map was constructed from water-level measurements in shallow wells and from surface-water levels. Water levels near the well fields are significantly lowered by pumping, and heavy sustained pumping also reduces flow in the Ramapo River. Although the effects of pumping are not evident on the map, cones of influence surround each pumping center.

FIGURE 4F RAMAPO RIVER—MAHWAH RIVER AREA  
Ground-water movement

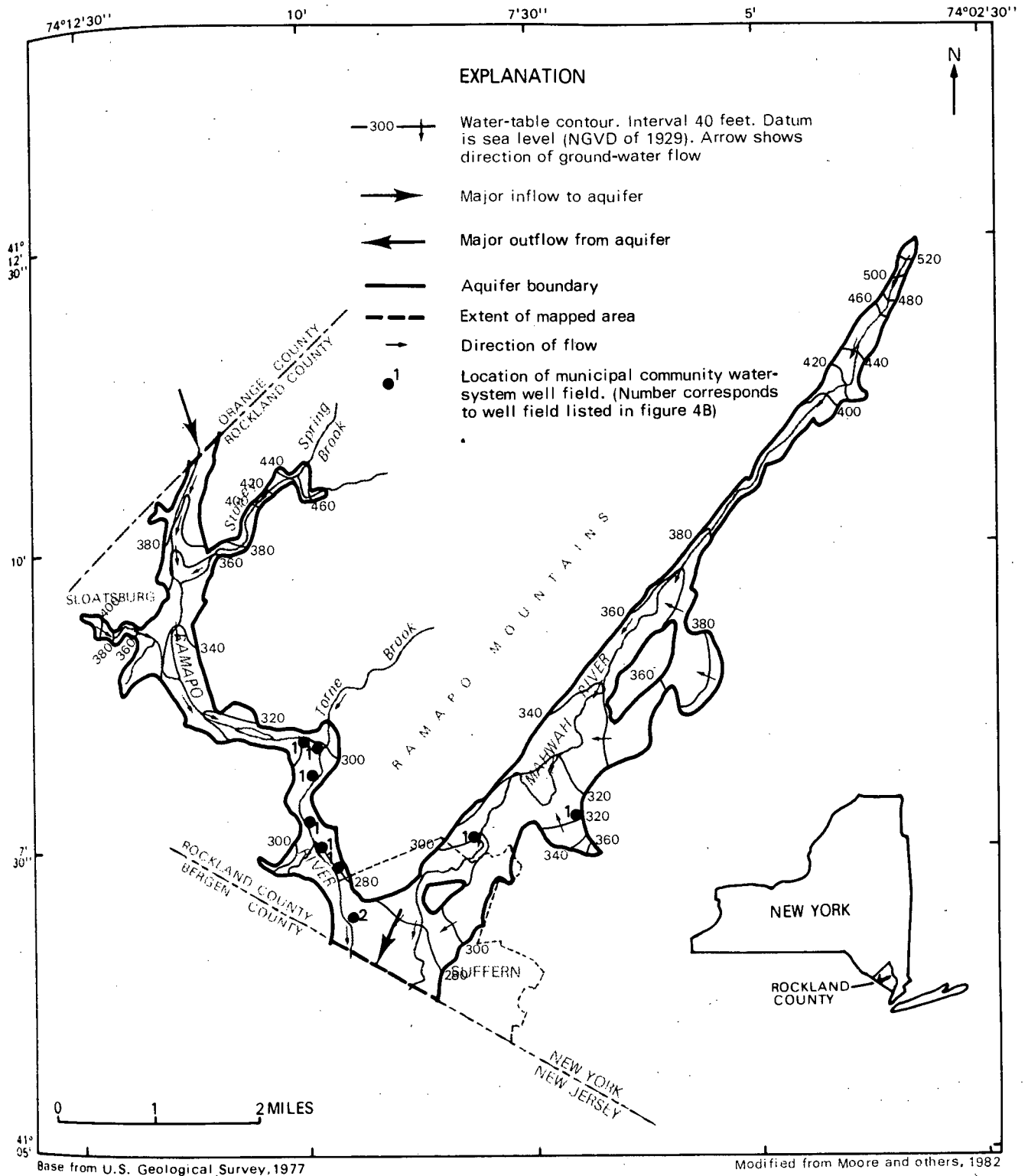
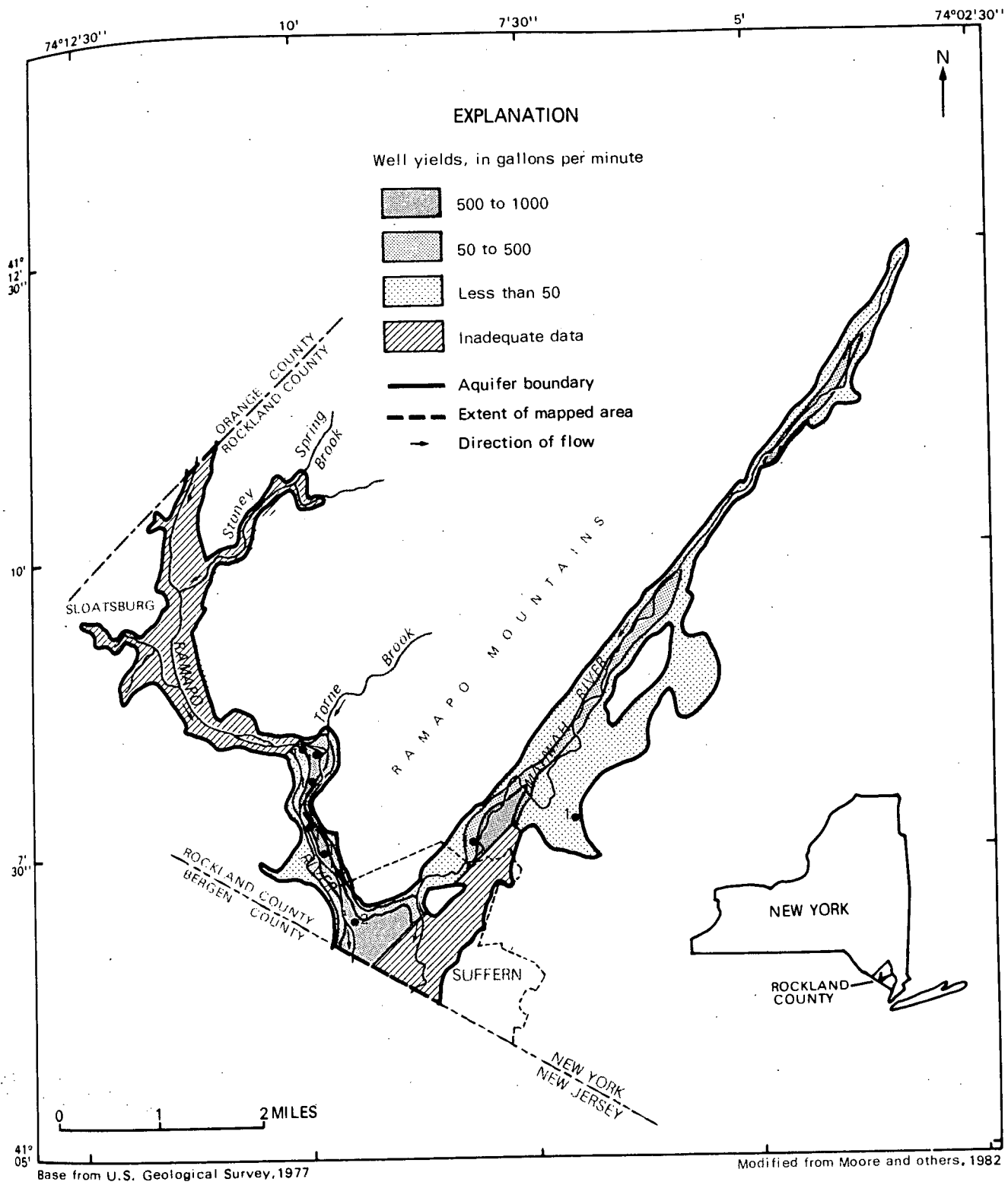


FIGURE 4G RAMAPO RIVER—MAHWAH RIVER AREA  
Well yields



4 RAMAPO RIVER—MAHWAH RIVER AREA  
G. Well yields

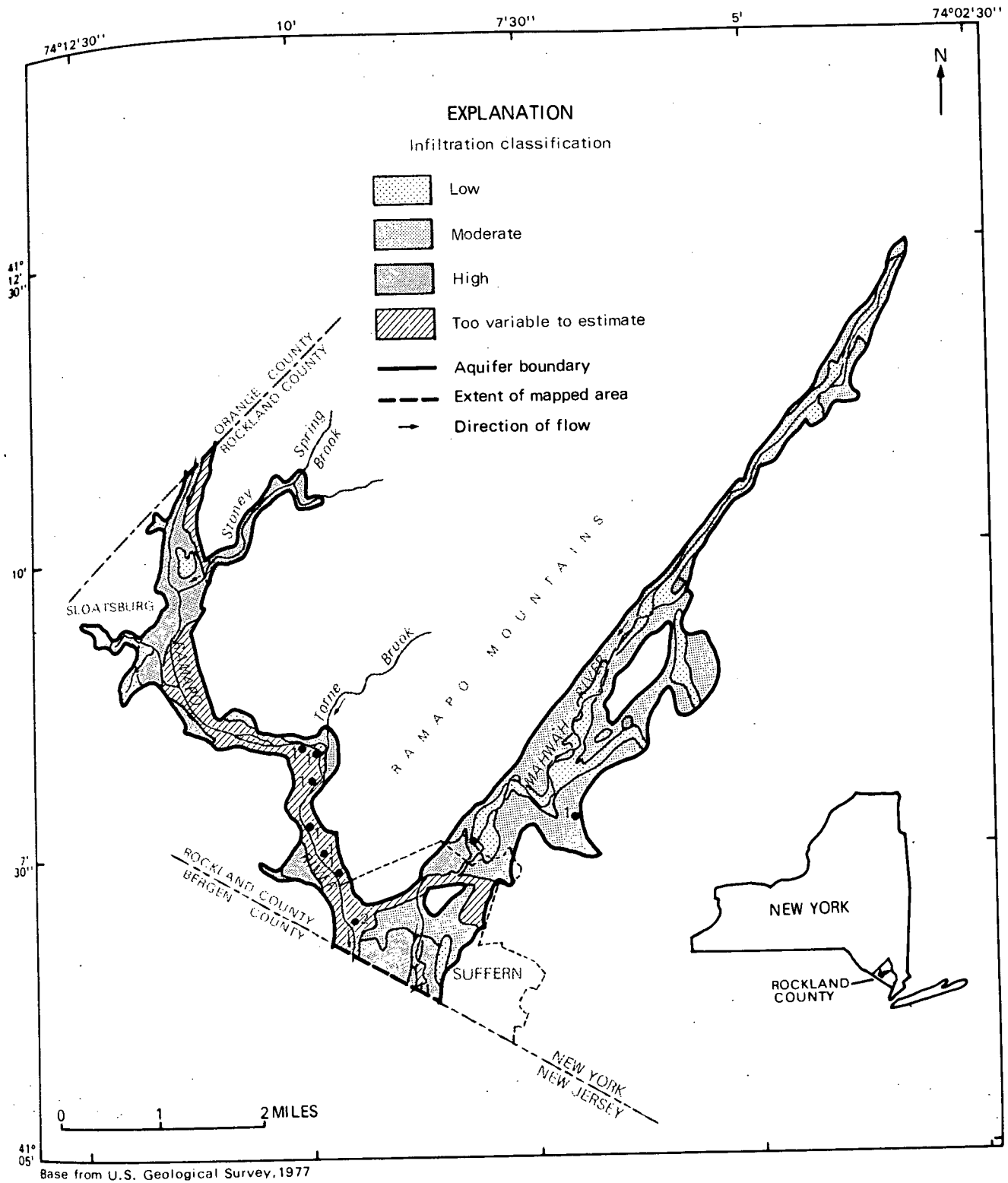
**Well yields are largest near the rivers and in thick, coarse deposits**

*Yields exceeding 500 gallons per minute can be obtained from wells at several locations within this aquifer, particularly near the rivers, where river water can be induced to flow through the aquifer toward the well.*

High well yields are generally obtainable adjacent to rivers, where pumping can induce river water to move into the aquifer. High yields are also available where saturated thickness of aquifer material is greatest. Yields up to 1,000 gal/min can be obtained in the southern part of the Ramapo limb of the aquifer and locally along the Mahwah limb. Where aquifer thickness is unknown or only inferred, well yields cannot be estimated.

Long-term yields may be affected by several factors, especially well design and proximity to other pumping wells. The values in figure 4G were derived from individual well yields (Leggette, Brashears and Graham, 1974), saturated thickness of permeable sand and gravel (see fig. 4E), and proximity to rivers. These yields are estimates of the maximum long-term yields from public-supply-type wells that fully penetrate the aquifer.

FIGURE 4H RAMAPO RIVER—MAHWAH RIVER AREA  
Soil-zone permeability



#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### H. Soil-zone permeability

**Much of the soil overlying the aquifer area is highly permeable**

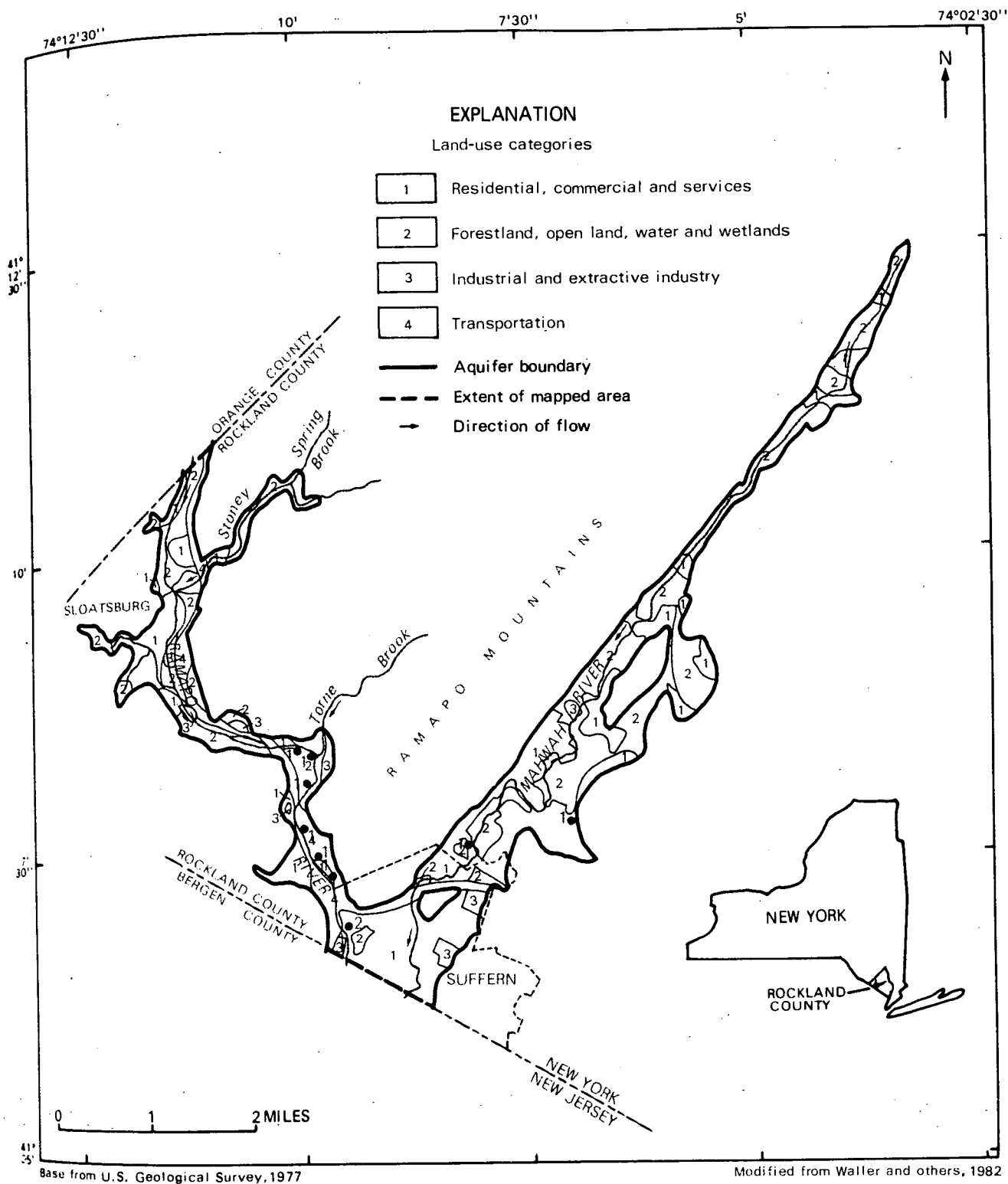
*Permeability of soils overlying this valley-fill aquifer ranges from moderate to high. Soils in some areas are too variable to map, largely as a result of man's activities.*

The Ramapo-Mahwah area contains a complex pattern of soil types. Much of the area is overlain by soils with moderate or high permeability. In some of the area, permeability is too variable to map because of changes resulting from human activity. Recharge and inflow in areas of moderate and high soil permeability will reach the aquifer more readily than in areas of low permeability.

The classification in figure 4H is a general estimate of how readily water can enter the soil zone and percolate into the underlying aquifer. Soils having the highest infiltration rates are those rich in sand; those having the lowest rates are those rich in clay and silt. The soil zone in this map is considered to be only the weathered part of the surficial geologic materials, which in this area is 18 to 30 inches thick.

Infiltration rate varies locally and seasonally, depending upon such factors as soil moisture and temperature, density of vegetation, slope, soil porosity, grain-size distribution, depth to seasonal high-water table, presence or absence of a water-impeding layer (fragipan), and the intensity and duration of rainfall, as well as other meteorological factors.

FIGURE 4I RAMAPO RIVER—MAHWAH RIVER AREA  
Land use



#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### I. Land use

**The southern part of the area is commercial; the rest is mostly rural**

*Land overlying this aquifer contains a major highway, commercial land, residential land, forests, open public land, wetlands, and some industry.*

A major transportation corridor, including a railroad and part of the New York State Thruway, crosses over the southern part of the aquifer and extends up the Ramapo limb (fig. 4I)<sup>1</sup>. In addition, the southern section of each limb contains extensive commercial and residential land uses. The northern sections, which are predominantly forest, open public land, open water, and wetlands, contain pockets of residential and commercial development, the largest of which is the Village of Sloatsburg in the Ramapo Valley.

<sup>1</sup> Land use was compiled from the 1968 Land Use and Natural Resources Inventory (LUNR) by Cornell University for the New York State Department of Transportation.

#### 4 RAMAPO RIVER—MAHWAH RIVER AREA

##### J. Present and potential problems

### **The southern part of this aquifer is vulnerable to contamination and overdraft**

*Extensive localized ground-water withdrawals are decreasing river flow. Detectable levels of an organic contaminant in some wells indicate that man is adversely affecting the aquifer.*

Extensive well-field development in the Ramapo limb of the aquifer has diminished the aquifer's ability to yield adequate quantities of water elsewhere. In addition, the aquifer extends into New Jersey, which raises legal questions as to the ownership of ground water and the related streamflow in the Ramapo River. Recent pumping tests have shown the close relationship between ground-water withdrawals and streamflow declines. Streamflow was reduced dramatically after several well fields were pumped simultaneously for a 24-hour period (New York State Department of Environmental Conservation, unpublished data, 1981). During times of drought, this reduction may be significant and may adversely affect New Jersey residents downstream.

Changes in water quality through man's activities are highly probable in this aquifer system. The free (unconfined) water table, highly permeable soils, an extensive transportation network, and extensive urbanization together create a large potential for ground-water contamination.

Analyses of two water samples from the aquifer have been documented. The first was a composite sample taken on January 10, 1972, from Suffern village wells (locations shown in fig. 4I). Concentrations of the 48 chemicals analyzed indicated that the water was of acceptable quality for drinking (U.S. Geological Survey, 1980). However, a moderate concentration of sodium (29 mg/L) may be of concern to those on severely restrictive sodium diets. The second sample, also from the Suffern wells (Kim and Stone, 1979), revealed detectable levels of synthetic organic contaminant 1,1,1 Trichloroethane at a concentration of 170  $\mu\text{g/L}$  (roughly 170 parts per billion). This test was made in response to a consumer complaint to State and local health departments.

A large municipal landfill within soil of high permeability adjacent to the aquifer at the junction of Torne Brook and the aquifer (see fig. 4A) has a high potential for contaminating the aquifer. Leachate from the landfill may have reached the Ramapo River and aquifer.